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September 20, 2009

To **USPTO**
Att. Mr/Mrs **Johnson, Vicky A,** primary examiner
Art unit **3656**

Application No **10/577,165** (filing date **04/26/2006**)
Titled: **Cam drive mechanism**
Inventor: John Pattakos et al.

Dear Madam/Sir,

Thank you for your DETAILED ACTION, wherein claims 1-3 and 5 are rejected as being unpatentable over Fleming US 4,301,776.

According this DETAILED ACTION:
" Fleming discloses a motion converting mechanism comprising a *reciprocating member* (12) and a *rotating member* (21); said reciprocating member (12) comprising at least two roller cam followers (25) in substantially constant distance from each other; said rotating member (21) comprising a cam (23); for each rotation of the cam (23) only one reciprocation of the reciprocating member (12) takes place; characterized in that: the centers of the roller cam followers follow curves (see Fig 1)"

If in the original claim 3 of the present application:

"A motion converting mechanism according claim 1, characterized in that the reciprocating member comprises at least one roller (4) riding *either on an immovable surface (16) or* on a rotating cooperating cam (11) and bearing thrust loads at low friction to improve mechanical efficiency and reliability."

the phrase in the italics is erased the claim 3 becomes:

A motion converting mechanism according claim 1, characterized in that the reciprocating member comprises at least one roller (4) riding on a rotating cooperating cam (11) and

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bearing thrust loads at low friction to improve mechanical efficiency and reliability.

All Figures from Fig. 5 to Fig. 15 specify the mechanism of this modified claim.

Some disadvantages of this version are:

1. This double cam version adds at least one additional cam (11), one additional gear (13), one additional gear (14) and a pair of additional rollers (4).
2. A great part of gas torque and energy and inertia torque travels through the gearing (13), (14) with the inevitable additional mechanical losses.
3. The frame that connects the rollers (5) of the cam (9) with the additional rollers (4) of the additional cam (11) adds additional reciprocating mass.
4. The meshed gears (13) and (14) add noise and friction.
5. The correct cooperation of the additional rollers (4), as they ride on the additional cam (11), with the rollers (5), as the later ride on the cam (9), necessitates increased accuracy, rigidity and stiffness of the frame that connects the rollers (4) of the additional cam (11) with the rollers (5) of the cam (9)

Some advantages resulting from the additional cam (11) (not existing in the prior art, according USPTO and PCT search reports) and the additional rollers (4) (not existing in the prior art) are:

1. The elimination of the lateral (thrust) forces (due to gas forces and to inertia forces) of the piston assembly of the prior art.
2. The distribution of the gas forces over twice as many rollers and cams, versus the prior art.
3. The sharing of the inertia loads (especially of the impact ones) on twice as many rollers and cams.
6. The two counter-rotating camshafts have "complementary" form (as they are counter-rotating) that allows them to get close to each other without collision. This, in turn, allows a compact and robust engine casing as well as a lightweight, compact and robust frame that holds all the rollers, i.e. the additional rollers (4) of the additional camshaft 8, too (Fig. 8 and Fig. 6 to 14).

7. The additional counter-rotating camshaft 8, (in cooperation with the shaft 7) balances the inertia forces, making the two cam engines (like the one in Fig 13) full balanced, in terms of inertia forces, and the three inline of Fig. 8 to 12 full balanced in terms of inertia forces, and inertia moments and inertia torques. The three inline with the two counter-rotating camshafts gets as inertia-vibration-free as the Wankel rotary engine and the best V-12 conventional engines, i.e. one of the smallest and most efficient engines becomes as smooth as the best existing engines.
8. In case of divided load, for instance in the case of an electric power plant having two counter-rotating electric generators, one at each end of the engine, or in the case of an outboard engine driving two counter-rotating screws (propellers), the power is equally shared to the two camshafts and the synchronizing rearing operates without load (unloaded). The engine frame is not only absolutely free from inertia vibrations of any order, but it is also absolutely free from power pulses vibrations of any order too. In applications where the absence of vibrations is vital, the efficient, compact, lightweight and cheap three inline of Figs 8 to 12, is way better even than the Wankel rotary engine and the conventional V-12, because only with the two counter-rotating camshafts the engine basis is rid of power pulses vibrations.

The applicant thinks that the aforementioned obvious disadvantages (that the addition of a second cam (11) and the addition of a second pair of rollers (4) and the addition of a pair of meshed gears (13), (14) inevitably introduce) may be offset/outbalanced/justified by the extra advantages mentioned, over the single cam arrangements of the prior art.

The specification, paragraph [16] to [24] reads:
[16] In a preferred embodiment the motion converting mechanism of Fig. 8 consists of a pair of counter-rotating shafts (7) and (8).
[17] The shaft (7) has double-disk cams (9) and (10) to allow room for the cam (11) of the shaft (8).
[18] The profile of the cams, i.e. the control surface of the cams is made so that to derive a harmonic reciprocation for the piston rod.
[19] By the mathematical term harmonic it is meant a strictly sinusoidal motion versus the time, i.e. versus the shaft-angle in the

case of a single lobe cam and versus the shaft-angle times the lobe number for the cases of multi-lobe cams.

[20] The balance of inertia forces and moments for such a reciprocation is simple, even for a single cylinder or a twin, by virtue of a couple of counterweight webs fixed on the shafts, but only in case of single-lobe cams.

[21] The additional merit of the three-in-line of the fig. 8, as compared to the single or twin, is that besides being perfectly balanced with respect to inertia forces and moments, i.e. the rocking moments along the shaft, it is also full balanced with respect to the inertia torques, i.e. the twisting moments about the shaft. This feature makes it as perfectly balanced as the Wankel rotary engine.

[22] Higher order harmonic components can be added to or subtracted from the single-lobe, kidney-shape, cam as shown in Fig.2.

[23] In the multi-lobe cams, of the prior art, the time for one rotation of the multi-lobe cam is longer than the time for a reciprocation of the reciprocating member, thus balance web on them provide no good. Hence, if something makes them in the future desirable, the balance of the engine will necessitate additional counterweigh shafts faster than the drive shaft.

[24] Multi-lobe cams impact, as many times as the number of lobes, stronger momentary torques from combustion and even worse torque impacts from inertia, which means as many times stronger impacts for the whole mechanism, gearing included.

Thank you
John Pattakos

Email: john.pattakos@pattakon.com
Web : www.pattakon.com

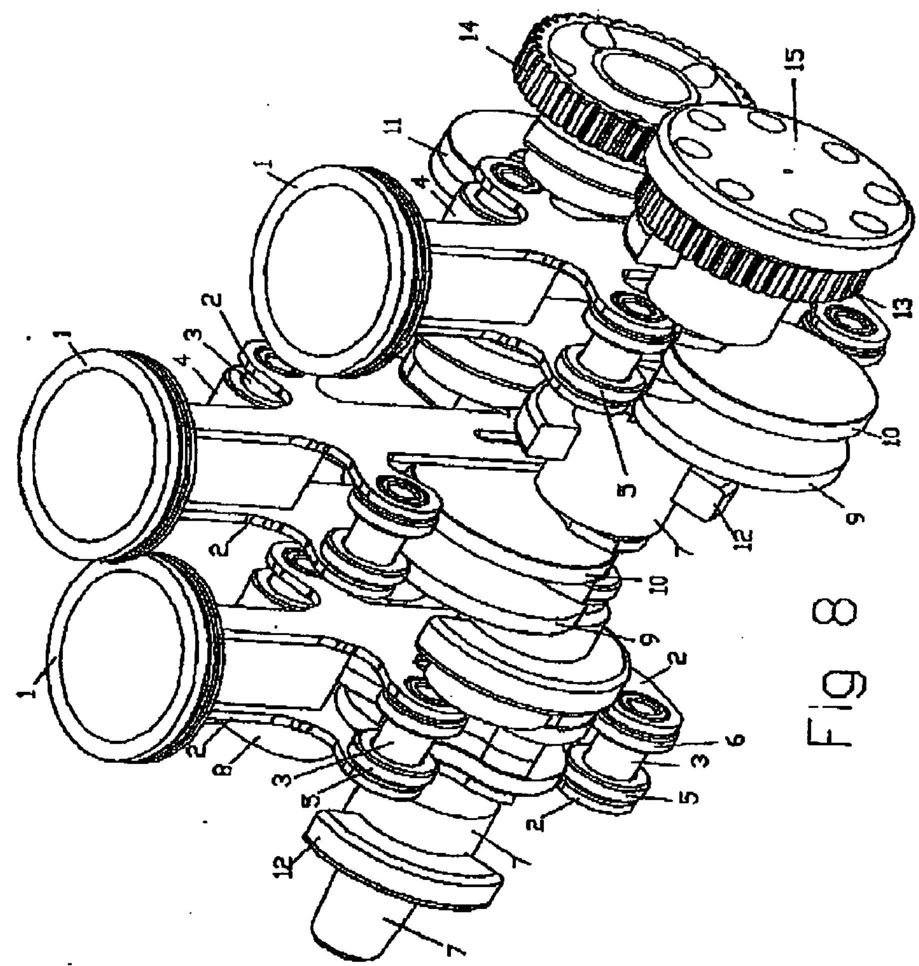

Fig 8